SILICON N-P-N "overlay" TRANSISTOR

2N5108

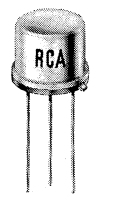
File No. 280

RCA-2N5108* is an epitaxial silicon n-p-n planar transistor of the "overlay" emitter electrode construction. It is intended as a high power amplifier, fundamental frequency oscillator and frequency multiplier. It may be used in final, driver, and pre-driver amplifier stages in UHF equipment and as a fundamental frequency oscillator at 1.68 GHz.

In the overlay structure, there are a number of individual emitter sites which are all connected in parallel and used in conjunction with a common collector region. When compared with other structures, this arrangement provides a substantial increase in emitter periphery for higher current or power, and a corresponding decrease in emitter and collector areas for lower input and output capacitances. The overlay structure thus provides greater power output, gain, efficiency, frequency capability, and linearity.

*Formerly RCA-Dev. No.TA2710

High-Gain Device for Class-B or C Operation in UHF Circuits



JEDEC TO-39

H-1381

- 1 Watt Output Min. at 1 GHz (5 dB Gain)
- For Sonde Applications
  0.3 Watt Output Typ. at 1.68 GHz

RATINGS

Maximum Ratings, *Absolute-Maximum Values:*

COLLECTOR-TO-BASE VOLTAGE . . .	V_{CBO}	55	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With external base-to-emitter resistance, R_{BE} = 10 Ω	V_{CER}	55	V
With base open	V_{CEO}	30	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	3	V
COLLECTOR CURRENT.	I_C	0.4	A
TRANSISTOR DISSIPATION.	P_T		
At case temperatures up to 25° C . . .		3.5	W
At case temperatures above 25° C . . .		See *Fig.7.*	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		-65 to 200	°C
LEAD TEMPERATURE (During soldering):			
At distance ≥ 1/32 in. from insulating wafer for 10 s max.		230	°C

TYPICAL POWER OUTPUT vs. FREQUENCY

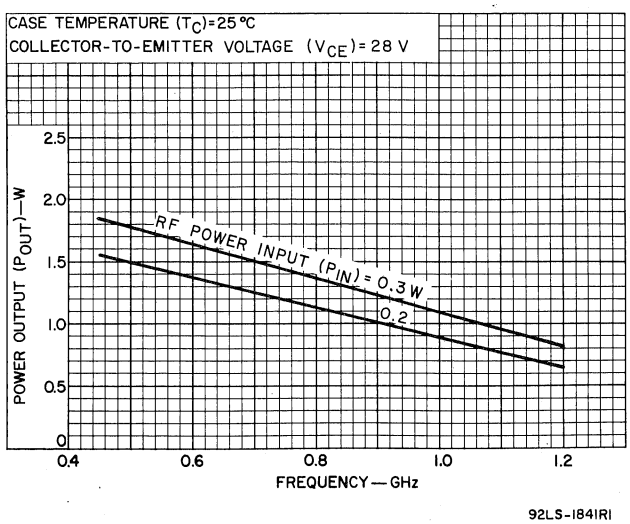


Fig. 1

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ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

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ELECTRICAL CHARACTERISTICS

Case Temperature = 25° C

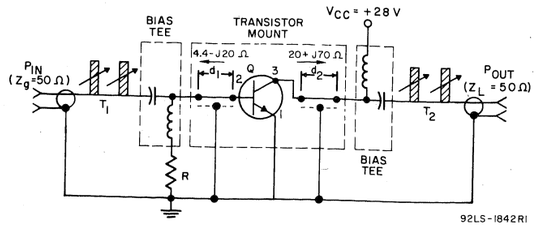
Characteristic	Symbol	Test Conditions: DC Collector Volts V_{CB}	Test Conditions: DC Collector Volts V_{CE}	Test Conditions: DC Current (mA) I_E	Test Conditions: DC Current (mA) I_B	Test Conditions: DC Current (mA) I_C	Limits Min.	Limits Max.	Units
Collector-Cutoff Current	I_{CEO}		15		0		-	20	μA
	I_{CES}		50					1	μA
Collector-to-Base Breakdown Voltage	BV_{CBO}			0		0.1	55	-	V
Collector-to-Emitter Sustaining Voltage: With external base-to-emitter resistance (R_{BE}) = 10 Ω	$V_{CER(sus)}$					5	55[a]	—	V
Emitter-to-Base Breakdown Voltage	BV_{EBO}			0.1		0	3	-	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$				10	100	-	0.5	V
Collector-to-Base Capacitance (Measured at 1 MHz)	C_{ob}	30		0			-	3.0	pF
Small Signal (Common Emitter) Forward Current Transfer Ratio (Measured at 200 MHz)	$\lvert h_{fe} \rvert$		15			50	6.0	-	
RF Power Output Common Emitter Amplifier at 1 GHz (See *Fig.2.*)	P_{OUT}		28				1[b]	-	W
RF Power Output Fundamental Frequency Oscillator at 1.68 GHz (See *Fig.4.*)	P_{OUT}		20				0.3[c] (typ.)		W

[a] Pulsed through an inductor (2.5 mH), duty factor = 50%.

[b] For P_{in} = 0.316 W, minimum efficiency = 35%.

[c] Minimum efficiency = 15%. (V_{EB} = 1.5 V)

RF AMPLIFIER CIRCUIT FOR POWER OUTPUT TEST (1-GHz Operation)



d_1: 1" Input line, center conductor width = .280"
d_2: 1" Output line, center conductor width = .125"
Q: 2N5108
R: 3.9 ohms
T_1, T_2: Microlab Double Stub Tuner
Bias Tee: Microlab 08N, or equivalent
Transistor Mount: 1/32" Microstrip board

Note: Imdepance measurements are made of transistor socket pins.

Fig. 2

TYPICAL RF POWER OUTPUT vs. COLLECTOR-TO-EMITTER VOLTAGE

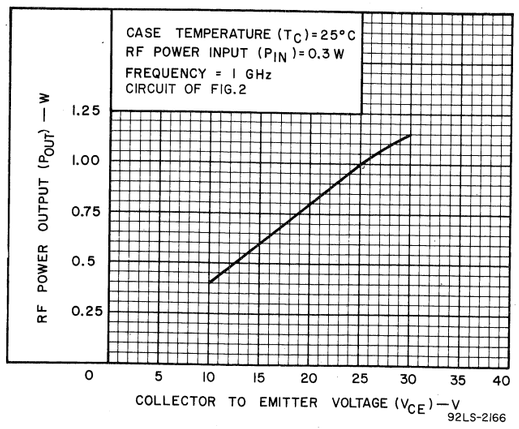
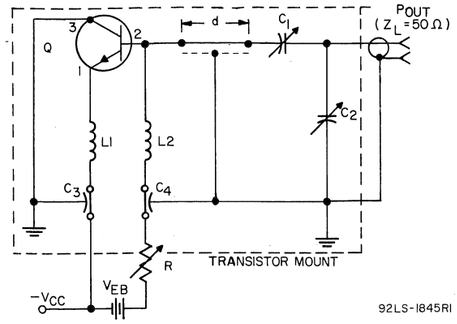


Fig. 3

RF FUNDAMENTAL-FREQUENCY OSCILLATOR CIRCUIT for POWER OUTPUT TEST (1.68-GHz Operation)



C_1, C_2: 0.35-3.5 pF
C_3, C_4: 500 pF feed through 3/4" output line, center
d: 3/4" output line, center conductor width = 0.160"
L_1, L_2: RF choke — 5 turns, No.28 wire, 1/8" dia. x 1/2" long
Q: 2N5108
R: 0-50 ohms
Transistor Mount: 1/16" microstrip board

Fig. 4

TYPICAL OSCILLATOR POWER OUTPUT vs. COLLECTOR SUPPLY VOLTAGE

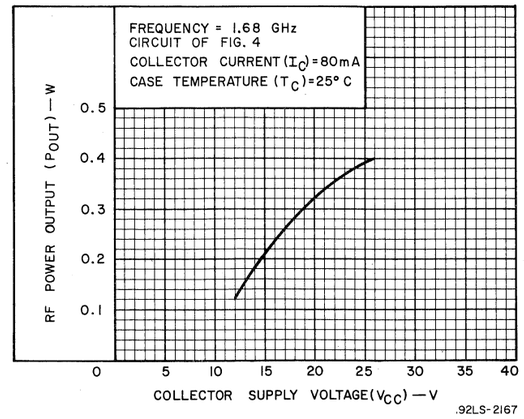


Fig. 5

TYPICAL RF AMPLIFIER CIRCUIT (1-GHz Operation)

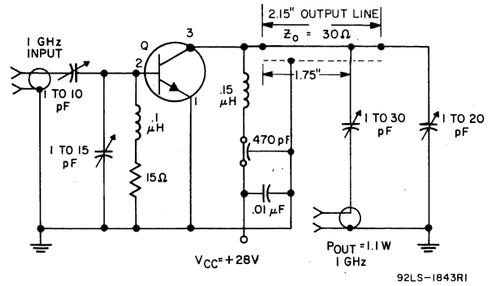


Fig. 6

DISSIPATION DERATING CURVE

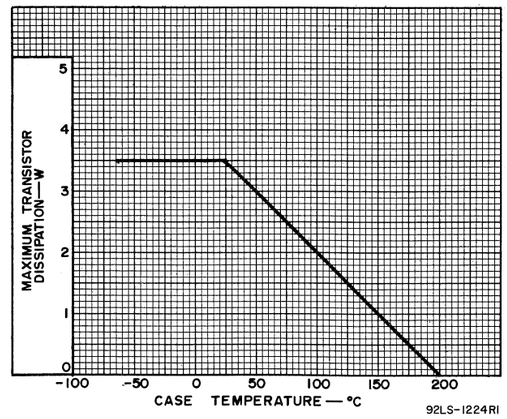
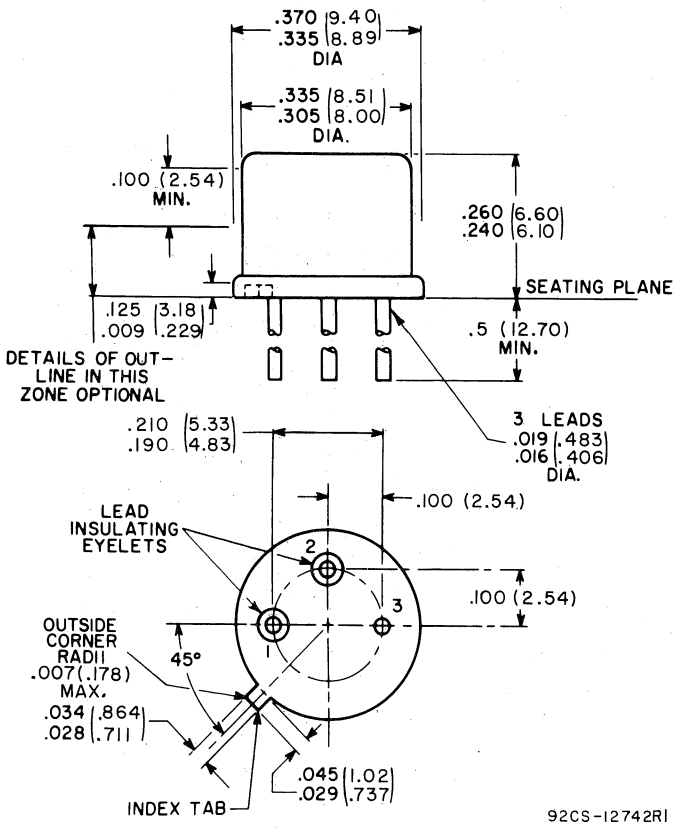


Fig. 7

DIMENSIONAL OUTLINE
JEDEC TO-39



DIMENSIONS IN INCHES AND MILLIMETERS

TERMINAL CONNECTIONS

Lead No.1 - Emitter
Lead No.2 - Base
Case, Lead No.3 - Collector

Note: *Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated.*

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